

Applicant(s): Douglas LeCrone, Daniel A. Murphy and Denis Hall
Serial No.: Continuation of 09/344,999 99-035CON
Filed: Herewith

In the Claims

Please cancel claims 1 through 50 and insert claims 51 through 91 as follows:

Claims 1 through 50 (canceled).

51 (new). A program for obtaining information about the number of updates to data blocks in data block locations in a data storage facility over a time interval, said program comprising processes for providing:

- A) a definition of a data group set of at least one of the data blocks,
- B) a definition of an interval corresponding to the time period for which update information is desired,
- C) a recording, during the defined interval, of only a first update to each data block location for data in the data group set,
- D) a transfer to the data group set of the information obtained by said recording after the defined interval,
- E) a determination, from the information in the data group set, the total number of data block locations in the data group set that were updated at least one time during the defined interval, and

Applicant(s): Douglas LeCrone, Daniel A. Murphy and Denis Hall
Serial No.: Continuation of 09/344,999 99-035CON
Filed: Herewith

F) a conversion of the total number of data block locations changed during into bandwidth based information about all the transfers involved in updating during the defined interval.

52 (new). A program as recited in claim 51 wherein said recording includes a definition of a flag for each data block and altering the state of each flag upon receiving a first update to a corresponding data block.

53 (new). A program as recited in claim 2 wherein said recording additionally includes:

- i) an establishment of a first state for each flag at the beginning of the defined interval, and
- ii) an establishment of a second state for an individual flag when the corresponding data block is updated a first time, said recording counting the total number of flags in the second state at the end of the defined interval.

54 (new). A program as recited in claim 52 wherein said recording includes a storage in an other dataset an identification of the time interval, data group and the defined flags.

Applicant(s): Douglas LeCrone, Daniel A. Murphy and Denis Hall
Serial No.: Continuation of 09/344,999 99-035CON
Filed: Herewith

55 (new). A program as recited in claim 52 wherein the defined interval is divided into subintervals and said recording includes a storage, for each data group in the data group set, of identifications of the subinterval and data group and the defined flags.

56 (new). A program as recited in claim 55 wherein said recording includes:

- i) an establishment of a first state for each flag at the beginning of each sample subinterval, and
- ii) an establishment of a second state for an individual flag when the corresponding data block is updated for a first time, said recording counting the total number of flags in the second state at the end of the sample subinterval.

57 (new). A program as recited in claim 51 wherein updates to the data storage facility are copied over a data communications path having predetermined characteristics to a data facility, said program additionally comprising a determination, from information obtained during said recording in combination with a first characteristic of

Applicant(s): Douglas LeCrone, Daniel A. Murphy and Denis Hall
Serial No.: Continuation of 09/344,999 99-035CON
Filed: Herewith

the data communications path, of a second characteristic of the data communications path.

58 (new). A program as recited in claim 57 wherein the data facility operates as a mirror for the data storage facility for maintaining a synchronized copy of the data therein and wherein said program obtains, as the first and seconds characteristics respectively, bandwidth and time for the mirror to achieve synchronism for the recorded update activity for that given bandwidth.

59 (new). A program as recited in claim 57 wherein the data facility operates as a mirror for the data storage facility for maintaining a synchronized copy of the data therein and wherein said program determines as the first and second characteristics respectively, the time required for the mirror to achieve synchronism for the recorded update activity and the bandwidth required to achieve that resynchronization time.

60 (new). A program for determining, from a local site with a local data storage facility, bandwidth related characteristics for a communications path that transfers data, produced by update operations, between first and

Applicant(s): Douglas LeCrone, Daniel A. Murphy and Denis Hall
Serial No.: Continuation of 09/344,999 99-035CON
Filed: Herewith

second remote data storage facilities over a communications path wherein each of the data storage facilities stores data in datasets in data blocks, said program comprising processes for providing:

- A) a definition of a set of data blocks in the local site data storage facility,
- B) a definition of defining a time interval,
- C) a recording of an identification of each data block in the local data storage facility that is updated during the interval,
- D) a determination, upon completion of the time interval, of the number of data blocks in the defined set of data blocks that were updated during the time interval, and
- E) a conversion of the information based upon the number of data blocks that were changed during the defined time interval into bandwidth related properties of the communications path.

61 (new). A program as recited in claim 10 wherein said recording includes:

- i) a definition of a table with a position corresponding to each of the defined data blocks

Applicant(s): Douglas LeCrone, Daniel A. Murphy and Denis Hall
Serial No.: Continuation of 09/344,999 99-035CON
Filed: Herewith

tracks and each position being set to a first state, and

- ii) a setting of a position corresponding to a defined data block during the defined time interval to a second state in response to a first update operation.

62 (new). A program as recited in claim 61 wherein said recording occurs over a plurality of defined time intervals and said recording sets all the table positions to the first state at the beginning of each of the time intervals.

63 (new). A program as recited in claim 62 additionally comprising a storage of the contents of the table after each of the time intervals with a date-time stamp corresponding to the interval.

64 (new). A program as recited in claim 63 wherein said determination includes:

- i) a definition of a report to be generated including a time frame including at least one time interval for the report,

Applicant(s): Douglas LeCrone, Daniel A. Murphy and Denis Hall
Serial No.: Continuation of 09/344,999 99-035CON
Filed: Herewith

- ii) a processing of the stored contents of the table with date-time stamps within the time frame, and
- iii) a generation of a report with the numbers of track changes recorded in the processed contents.

65 (new). A program as recited in claim 64 wherein the local disk storage facility includes a controller including a set of logical volumes and the defined data blocks include all the data blocks in the controller, said report definition including the generation of a corresponding reporter command, said processing including combining all the data block changes for the controller for all of the time intervals.

66 (new). A program as recited in claim 65 wherein said processing includes the combination of the date-time stamped contents of each table in the report time frame in a logical OR operation to obtain a final table and the counting of the total number of positions in the final table set to the second state.

67 (new). A program as recited in claim 66 additionally comprising the generation of the reporter command with one

Applicant(s): Douglas LeCrone, Daniel A. Murphy and Denis Hall
Serial No.: Continuation of 09/344,999 99-035CON
Filed: Herewith

parameter specifying a resynchronization time in which corresponding updates should be completed between the first and second remote data storage facilities, said processing providing the required bandwidth of the communications path to provide that resynchronization time.

68 (new). A program as recited in claim 67 wherein the communications path includes at least one path with a characteristic bandwidth, said program including a process for determining said bandwidth by dividing the required bandwidth by the number of paths to obtain the characteristic bandwidth.

69 (new). A program as recited in claim 67 wherein the communications path will include at least one path with a characteristic bandwidth, said program including a process for determining the bandwidth by dividing the required bandwidth by the characteristic bandwidth to determine the number of required paths.

70 (new). A program as recited in claim 66 additionally comprising the generation of the reporter command with one parameter specifying an available bandwidth of the

Applicant(s): Douglas LeCrone, Daniel A. Murphy and Denis Hall
Serial No.: Continuation of 09/344,999 99-035CON
Filed: Herewith

communications path, said program including a process for providing a resynchronization time during which all updates to the first remote data storage facility will be transferred over the communications path to the second remote data storage facility.

71 (new). A program as recited in claim 70 wherein the communications path includes at least one path having a characteristic bandwidth, said program providing the bandwidth as the mathematical product of the number of paths and the characteristic bandwidth.

72 (new). A program as recited in claim 64 wherein the local data storage facility includes a plurality logical volumes and the defined data blocks include all the data blocks in the controller, said generation of the reporter command including the definition of a logical volume report for a set of at least one logical volume, said the combination of all the data block changes for each of the defined logical volumes.

73 (new). A program as recited in claim 72 wherein said program includes the combination of all the contents of the table for a logical volume in a logical OR operation to obtain a

Applicant(s): Douglas LeCrone, Daniel A. Murphy and Denis Hall
Serial No.: Continuation of 09/344,999 99-035CON
Filed: Herewith

final table and the summing of the positions in the final table that are set to the second state.

74 (new). A program as recited in claim 66 wherein the local disk storage facility includes a plurality logical volumes and each logical volume includes at least one dataset, said generation of the reporter command defining a dataset report with a set of at least one dataset, said program including the combination of all the data block changes for each of the defined datasets.

75 (new). A program as recited in claim 74 wherein said program additionally includes the definition of a mask of the data blocks forming the defined datasets, the generation of a final table that is the logical OR of all the tables in the logical volume containing the defined datasets and the combination of the mask and the final table in a logical AND operation.

76 (new). A program for determining, from a local site with a local data storage facility, bandwidth related characteristics for a communications path that transfers data, produced by update operations, between first and second remote data storage facilities over a communications path wherein each of the data storage

Applicant(s): Douglas LeCrone, Daniel A. Murphy and Denis Hall
Serial No.: Continuation of 09/344,999 99-035CON
Filed: Herewith

facilities stores data in datasets on disk tracks, said
program comprising processes for providing:

- A) a definition of a set of disk tracks in the local
site data storage facility,
- B) a definition of defining a time interval,
- C) a recording of an identification of each disk track
in the local data storage facility that is updated
during the interval,
- D) a determination, upon completion of the time
interval, of the number of tracks in the defined set
of disk tracks that were updated during the time
interval, and
- E) a conversion of the information based upon the number
of disk tracks that were changed during the defined
time interval into bandwidth related properties of
the communications path.

77 (new). A program as recited in claim 76 wherein said
recording includes:

- i) a definition of a table with a position
corresponding to each of the defined disk tracks
and each position being set to a first state,
and

Applicant(s): Douglas LeCrone, Daniel A. Murphy and Denis Hall
Serial No.: Continuation of 09/344,999 99-035CON
Filed: Herewith

- ii) a setting of a position corresponding to a defined disk track during the defined time interval to a second state in response to a first update operation.

78 (new). A program as recited in claim 77 wherein said recording occurs over a plurality of defined time intervals and said recording sets all the table positions to the first state at the beginning of each of the time intervals.

79 (new). A program as recited in claim 78 additionally comprising a storage of the contents of the table after each of the time intervals with a date-time stamp corresponding to the interval.

80 (new). A program as recited in claim 79 wherein said determination includes:

- i) a definition of a report to be generated including a time frame including at least one time interval for the report,
- ii) a processing of the stored contents of the table with date-time stamps within the time frame, and

Applicant(s): Douglas LeCrone, Daniel A. Murphy and Denis Hall
Serial No.: Continuation of 09/344,999 99-035CON
Filed: Herewith

iii) a generation of a report with the numbers of track changes recorded in the processed contents.

81 (new). A program as recited in claim 80 wherein the local disk storage facility includes a controller including a set of logical volumes and the defined disk tracks include all the disk tracks in the controller, said report definition including the generation of a corresponding reporter command, said processing including combining all the track changes for the controller for all of the time intervals.

82 (new). A program as recited in claim 81 wherein said processing includes the combination of the date-time stamped contents of each table in the report time frame in a logical OR operation to obtain a final table and the counting of the total number of positions in the final table set to the second state.

83 (new). A program as recited in claim 82 additionally comprising the generation of the reporter command with one parameter specifying a resynchronization time in which corresponding updates should be completed between the

Applicant(s): Douglas LeCrone, Daniel A. Murphy and Denis Hall
Serial No.: Continuation of 09/344,999 99-035CON
Filed: Herewith

first and second remote data storage facilities, said processing providing the required bandwidth of the communications path to provide that resynchronization time.

84 (new). A program as recited in claim 83 wherein the communications path includes at least one path with a characteristic bandwidth, said program including a process for determining said bandwidth by dividing the required bandwidth by the number of paths to obtain the characteristic bandwidth.

85 (new). A program as recited in claim 83 wherein the communications path will include at least one path with a characteristic bandwidth, said program including a process for determining the bandwidth by dividing the required bandwidth by the characteristic bandwidth to determine the number of required paths.

86 (new). A program as recited in claim 82 additionally comprising the generation of the reporter command with one parameter specifying an available bandwidth of the communications path, said program including a process for providing a resynchronization time during which all

Applicant(s): Douglas LeCrone, Daniel A. Murphy and Denis Hall
Serial No.: Continuation of 09/344,999 99-035CON
Filed: Herewith

updates to the first remote data storage facility will be transferred over the communications path to the second remote data storage facility.

87 (new). A program as recited in claim 86 wherein the communications path includes at least one path having a characteristic bandwidth, said program providing the bandwidth as the mathematical product of the number of paths and the characteristic bandwidth.

88 (new). A program as recited in claim 80 wherein the local data storage facility includes a plurality logical volumes and the defined disk tracks include all the disk tracks in the controller, said generation of the reporter command including the definition of a logical volume report for a set of at least one logical volume, said the combination of all the track changes for each of the defined logical volumes.

89 (new). A program as recited in claim 88 wherein said program includes the combination of all the contents of the table for a logical volume in a logical OR operation to obtain a final table and the summing of the positions in the final table that are set to the second state.

Applicant(s): Douglas LeCrone, Daniel A. Murphy and Denis Hall
Serial No.: Continuation of 09/344,999 99-035CON
Filed: Herewith

90 (new). A program as recited in claim 82 wherein the local disk storage facility includes a plurality logical volumes and each logical volume includes at least one dataset, said generation of the reporter command defining a dataset report with a set of at least one dataset, said program including the combination of all the track changes for each of the defined datasets.

91 (new). A program as recited in claim 90 wherein said program additionally includes the definition of a mask of the tracks forming the defined datasets, the generation of a final table that is the logical OR of all the tables in the logical volume containing the defined datasets and the combination of the mask and the final table in a logical AND operation.